TROUBLESHOOTING THE SHELL PROCESS

Operating problems can occasionally crop up, even in the most carefully supervised shell process operations. When they do, quick corrective action can make the difference between a minor inconvenience and a serious dollar expense to the foundry. This trouble shooting guide draws on the experience of HAI's field and laboratory personnel to summarize some of the more common shell process operating problems with suggested solutions that have been successfully used in other foundries. Also described are possible causes and solutions to resin coated sand problems themselves. Your HAI Account Manager is a trained foundryman who would welcome the opportunity of being of further assistance, should you so desire.

FOUNDRY OPERATING PROBLEMS

A. Peelback

POSSIBLE CAUSES	SOLUTIONS
Hot or cold spots in core box or on pattern	Rearrange heaters. For cold spots, add beryllium copper inserts.
Entire core box itself is too hot or too cold	Adjust core box temperature.
Low melt point sand	Change resin or refer to low melt point sand problem.
For cores – air pressure too high or too low	Periodically check air pressure settings. Use pulsating blow. Change angle of blow.
Moisture in the sand	Check moisture traps on air lines going to the blower.
Cold sand	Do not store sand in extremely cold area and review inventory handling polices.
Dirty patterns or core boxes	Clean patterns and boxes to improve heat transfer.

Maintain full head of sand in magazine (core blowers) and dump box (molding machines).

B. **Veining and Thermal Shock**

POSSIBLE CAUSES	SOLUTIONS
Pouring temperatures too high	Monitor pouring temperatures.
Stress areas in cores or molds	Check ejection system. Check uniformity of cooling.
Cores or molds are over-cured.	Shorten cure cycle.
Cores or molds are excessively brittle	Use vinsol in sand to increase thermoplasticity. Reduce hexa content.
Cores are too strong	Reduce resin content.
Base sand does not allow for enough expansion	Switch to a more angular clay bearing sand or add clay to the mix.
Uneven mold bonding	Check to see if locators are lining up properly.
Cores or molds are too cold	Check storage conditions.
Core or mold weights are too low	Increase weights by lengthening invest cycle. Possibly sand itself is cold.
Cores or molds have thin walled spots	Check for peelback or lamination.

Maintain an even depth or cure.

C. **Uneven Build-Up**

POSSIBLE CAUSES	SOLUTIONS
Poor heat distribution	Check arrangement of heaters.
Cores drain poorly	May require vibration
Dirty patterns or core boxes	Check patterns and boxes regularly.
Poor blow patterns	Check location of vents and blowholes.
Plugged vents	Check boxes periodically. Change type of vents.

D. **Lack of Build-Up**

POSSIBLE CAUSES	SOLUTIONS
Cool box or pattern	Raise box or pattern temperature.
Melt point of sand is too high	Use lower melt point resin or refer to high melt point sand problem.
Cold sand	Increase invest cycle and review sand storage conditions.
Too short an invest cycle	Increase invest cycle

E. **Excessive Build-Up**

POSSIBLE CAUSES	SOLUTIONS
Too hot a pattern or core box	Lower box or pattern temperature
Melt point of sand is too low	Use higher melt point resin or refer to high melt point sand problem.
Cores not draining properly	Vibrate during drain
Too long an invest cycle	Decrease invest cycle

F. **Poor Flowability or Blowability**

POSSIBLE CAUSES	SOLUTIONS
Plugged vents	Check vents regularly. Change type of vents.
Not enough vents	Add vents
Too hot a pattern or core box	Lower pattern or box temperature.
Low coated sand melt point	Use higher melt point resin or refer to low melt point sand problem.
Moisture in air line	Check moisture traps on periodic basis.
Insufficient amount of release agent in sand	Add more release.

Maintain a full magazine (core blowers) or dump box (molding machines).

G. **Metal Penetration**

POSSIBLE CAUSES	SOLUTIONS
Core not blown dense	Increase blow pressure
Surface of core or mold too brittle	Core or mold is over-cured. Decrease cure cycle or reduce mold or pattern temperature.
Sand too coarse or too open	Switch to a finer base sand. Use wash. Add fines-iron oxide, clay.

H. **Casting Porosity**

POSSIBLE CAUSES	SOLUTIONS
Under-cured mold or core surface	Lengthen core time
Excess gas generated at metal / sand interface	Decrease resin and / or hexa level
Permeability of base sand is too low	Use a coarser base sand

Inadequate venting of cores or molds	Add vents where needed
Need for a gas scavenger	Add iron oxide to the mix

I. **Sticking**

POSSIBLE CAUSES	SOLUTIONS
Core or mold is over cured	Decrease cure cycle
Release build-up in the core box or on the pattern	Clean the core box or pattern spray release less often.
Scored core box or pattern	Repair damaged boxes or patterns. Minimize damage.
Insufficient release agent in sand	Add more release to sand
Free resin in the coated sand	Refer to free resin in sand problems
Dusty resin coated sand	Sand has been over-mulled or has been subject to abrasion

J. **Weak Cores or Molds**

POSSIBLE CAUSES	SOLUTIONS
Low resin content	Check resin weigh up and LOI of sand. Increase resin level of sand.
Low hexa content	Check hexa weigh up. Increase hexa level
Cores or mold over or under cured	Check cure cycle and pattern temperatures.

K. **Odor**

POSSIBLE CAUSES	SOLUTIONS
Lack of deodorizer in the coated sand	Use deodorized sand
Eliminate vinsol	Use non-vinsol plasticized sand if required.

RESIN COATED SAND PROBLEMS

A. **Low Melt Point Sand**

POSSIBLE CAUSES	SOLUTIONS
Low starting sand temperature during coating operation	Check sand temperature controller. Increase heater temperature.
Time before hexa addition	Increase initial mulling time.
High moisture level in coated sand	Increase starting sand temperature. Reduce the amount of water in the hexa quench

	solution.
Base resin melt point too low	Switch to a higher melt point resin

B. **High Melt Point Sand**

POSSIBLE CAUSES	SOLUTIONS
High starting sand temperature during coating operation	Check sand temperature controller. Decrease heater temperature.
Insufficient quench water. This results in the coated sand being discharged hot at the end of the cycle.	Increase quench water
Base resin melt point too high	Switch to a lower melt point resin

C. **Free Resin in the Coated Sand**

POSSIBLE CAUSES	SOLUTIONS
Low starting sand temperature during coating	Check sand temperature controller. Increase heater temperature.
Cold muller	Pre-heat muller before coating
Short mulling time before quench addition	Increase mulling time.

D. **Low Hot Tensile Strength**

POSSIBLE CAUSES	SOLUTIONS
Low resin content	Check resin weigh up. Increase resin level
Low hexa content	Check hexa weigh up. Increase hexa level
Raw sand has excessive fines and / or clay	Check with raw sand supplier